SCOTTISH GEOLOGY.

The Geology of Eastern Fife. By Sir Archibald Geikie, D.C.L., F.R.S. Memoirs of the Geological Survey, Scotland. Pp. xv + 421 ; with map, 12 plates and 71 figures in the text. (Glasgow, 1902.) Price 8s.

IT is not given to every author of a Geological Survey memoir to write an interesting as well as instructive volume. Too little attention has been paid to style and composition, while the necessity for recording many and often dry facts has had a tendency to obscure the philosophy of the subject in many of the official publications.

When, however, as in the present instance, the information is conveyed in a pleasant style and in well-chosen language, we feel that the science is placed on a higher level and that the task has been performed in no perfunctory spirit, but with the desire to make art a companion of science.

Sir Archibald Geikie has occupied much of his leisure time since he retired from the Geological Survey in writing a memoir on the geology of eastern Fife, which may be regarded as a sequel to his " Geology of Central and Western Fife and Kinross," published two years ago. He conducts us now eastwards into a region perhaps fuller of geologic interest. Composed mainly of Old Red Sandstone and Carboniferous rocks, it is diversified by the occurrence of contemporaneous eruptive rocks in both systems and by the further evidence of later igneous action, probably for the most part of Permian age, in numerous volcanic vents—necks or chimneys—filled with tuff or agglomerate, and in sills and dykes of dolerite and basalt. As the author points out, there is hardly any other region in Britain where lessons in practical geology could be better taught. On the coast, the rocks have been dissected and washed clean and bare by the tides, and they afford illustrations of stratification, jointing, curvature, intrusion and other characteristic structures of the earth's crust. Fossils in great variety are found in many of the strata. The Old Red Sandstone of Dura Den is a classic locality, one of the chief repositories of the fishes such as Bothriolepis, Phyllolepis and Holoptychius. In the Carboniferous rocks, there are banks of corals and crinoids in the marine limestones, shales with ostracods and bone-beds with fish-remains in the estuarine strata, and plant remains with erect and prostrate tree-trunks in the more distinctly terrestrial deposits. A general list of all the fossils has been drawn up by Mr. B. N. Peach, who acknowledges the help received from several specialists.

Workable coal has locally been found in the Calciferous Sandstone Series, but the chief development of this mineral is in the Carboniferous Limestone Series and in the Coal-measures. Full particulars of these strata are given.

The author's attention is naturally attracted to the eruptive rocks, and more especially to those which have invaded the Carboniferous strata. The sills form a remarkable group ranging from a few inches to masses more than 100 feet thick that form prominent ranges of hills. They are nearly all dolerites. The distinctive feature in the geology of eastern Fife is, however, the series of volcanic necks, of which about eighty have been observed ; and, as the author remarks,

" they furnish an unrivalled body of material for the study of phenomena in the structure of volcanoes which are inaccessible at the active vents of to-day."

They

" mark the sites of former volcanic orifices by which egress was obtained to the surface for highly heated vapours, gases and other materials from the interior of the earth."

Notes on the petrography of the igneous rocks are contributed by Dr. J. S. Flett and Mr. H. J. Seymour.

Many other topics of interest are dealt with by the author, such as the glaciation, as evidenced by the ice-worn rock surfaces, the Boulder-clay and the Kames. The raised beaches and submerged forests likewise claim attention, and there is an instructive chapter on the latest geological changes in which the famous Links of St. Andrews and other places are duly described.

The work is illustrated by a clearly printed geological index map and numerous excellent pictorial views and sections.

ELEMENTARY MENSURATION.

Elementary Plane and Solid Mensuration, for use in Schools, Colleges and Technical Classes. By R. W. Edwards, M.A. Pp. xxx + 304. (London : Edward Arnold, 1902.) Price 3s. 6d.

THIS book begins with an explanation of the nature and use of logarithms, followed by that portion of trigonometry which deals with a single angle and the application thereto of logarithmic calculation. Then comes a short chapter on calculations relating to parallelograms, and this is followed by one on triangles, wherein there is such further development of trigonometry as is required for the solution of triangles from the usual data. After this, rectilinear figures are treated of in the order of simplicity—trapeziums, regular polygons, &c. We have then a very useful little chapter on similar figures of various kinds, illustrated by a considerable number of numerical examples, followed by one on irregular rectilinear figures in general. Next follow calculations relating to the circle, illustrated by nearly ninety examples. Modern demands for the employment of squared paper and graphic representation are satisfied by a short chapter on graphs, and this leads to an exposition and application of Simpson's rule. After this comes the treatment of solids in the order of simplicity, and all the well-known rules are proved and illustrated by numerous examples. No rule is given without the proof, the author saying in his preface that

" students of elementary mensuration are frequently obliged to be content with a mere statement of the rules employed and with working out examples on these rules."

This was, no doubt, true of treatises written thirty or forty years ago, but it has ceased to be a true criticism of recent works. The mensuration of solids concludes with a long chapter on the sphere which will be a help to the student in his study of spherical trigonometry.

It will thus be seen that this book contains all that is necessary for the ordinary work of the surveyor and the engineer, and that, as regards the amount of knowledge

of logarithms, algebra and trigonometry required as a preliminary, the work is self-contained.

The author says in the preface that he would "like to have added chapters on surfaces of revolution, centroids and radii of gyration"—subjects which are usually confined to treatises on the integral calculus. It is high time, however, to take them out of the exclusive control of the severe exponents of pure mathematics and to bring them more into contact with practical needs by means of arithmetic. More especially is this true with regard to what are called "moments of inertia"—a term so wide of the thing intended to be signified that it is a perpetual stumbling-block to perception in the mind of the average student. What can be the meaning of the "moment of inertia" of a mere *area* about an axis? Is not the notion of a *mean square of distance*, whether of a material body or of a mere area, from an axis something the nature of which is more readily grasped and firmly retained than the ordinary term *square of the radius of gyration?* The *square root of the mean square of distance* is what is universally called the "radius of gyration." No doubt, the expression sounds strange at first to the student, but the strangeness rapidly wears off; and the notion of a *mean square*, whether of distances or of velocities, is one which so often occurs in various branches of physics that benefit to the student would result if a "radius of gyration" were presented to him in this way. The notion is one which preeminently lends itself to arithmetical illustration and treatment; it is found, for example, to work admirably with certain engineering students, and we commend it to the consideration of Mr. Edwards when he prepares the second edition of his useful work.

OUR BOOK SHELF.

Traité encyclopédique de Photographie. Third supplement. By Charles Fabre. Pp. 423. (Paris: Gauthier-Villars, 1902.) Price 10 francs.

THIS supplement constitutes the seventh volume of Prof. Fabre's work, and covers the period from the date of the second supplement, 1897, to May of the present year. On turning over its pages, one cannot but be struck by the very large amount of space devoted to apparatus. More than 230 pages are so utilised, while negative making has but 54, direct printing methods 41, and photo-mechanical methods 11. It is needless to add that while lenses, cameras, shutters, &c., are dealt with in full detail, the progress of photography itself is inadequately treated. Some important matters, concerning which one would naturally turn to such a work as this, are omitted, and others are only referred to. This tendency to neglect photography for the sake of photographic apparatus is more or less general in the larger treatises on the subject; perhaps, therefore, this kind of manual best meets the general demand. But it is difficult to understand why the photographic student should desire a full technical description of every variety of objective and be satisfied with little more than a popular summary of work done in the science itself. We know of no treatise that gives any approach to a complete survey of the science of photography. And seeing that the present position of the science is so largely due to work done during the last ten, or at most about twenty, years, the need for a comprehensive treatise written from our present standpoint is obvious.

The character of Prof. Fabre's work is too well known

and appreciated to call for detailed reference in connection with a supplement. The author might perhaps have been a little more up to date in some respects. He might, for example, have stated that the Royal Photographic Society has at last withdrawn its unit of $f/4$ for lens apertures and recognised that the natural unit is $f/1$. On the other hand, he could not have recorded the similar step taken by the International Congress of Paris, as their acceptance of the natural unit was not announced until after the first part of the supplement was published. The table at p. 43, showing the various series of empirical numbers that have been used for indicating apertures, is therefore now almost wholly a matter of history.

Astronomy Without a Telescope. By E. Walter Maunder, F.R.A.S. Pp. xii + 272. (London: *Knowledge* Office, 1902.) Price 5s. net.

BY collecting these papers on "Constellation Studies," "The Zodiacal Light," and other subjects for the amateur astronomer, Mr. Maunder has directed attention to many interesting observations which can be made without instrumental aid.

The book is divided into three sections, (1) constellation studies, (2) astronomical exercises without a telescope, and (3) astronomical observations without a telescope; and it is illustrated by 44 charts and photographs, and 12 excellent star maps. The object of the book is to encourage naked-eye observations, and this is kept in mind throughout, though for some parts of the subject an ordinary field-glass is allowed.

In "Constellation Studies," the reader is introduced to the constellations and their units, an intimate knowledge of which the author counts a *sine qua non* in the prosecution of the exercises and observations mentioned in sections ii. and iii. This instruction is given in a readable and interesting form, and seems to deal with all the objects which are of interest to a naked-eye astronomer. With the aid of frequent quotations from Aratus and some of the ancient rhymesters, the historical and mythological allusions to constellation and star names are explained in an instructive manner.

In sections ii. and iii., the observer is given assistance for the *scientific* observation of some ten different astronomical phenomena. For instance, in the chapter on "Meteors," a list of questions is given which observations of the meteor should answer, and, further, the unnecessary, but usual, complicated remarks are indicated. In the chapter on "Auroræ," also, there are hints on what to look for and what to note; whilst such suggestions as an apparent connection between the apex of the "Zodiacal Light" and the Pleiades will encourage amateur astronomers to make patient and persistent observation. The chapter on "New Stars" indicates another field of possible usefulness.

With the exception of the introduction of "Columbia" for "Columba" on map 12, the book seems to be free from typographical errors, but we would express a regret that the names of the letters of the Greek alphabet, when used to designate a star, were not printed in a different type from that used for the *proper* names of the stars, because, despite the explanation of the alphabet given as an appendix, this is likely, at first, to form a stumbling-block to readers who are not familiar with the names of the Greek characters.

Aids to the Analysis and Assay of Ores, Metals, Fuels, &c. By J. J. Morgan, F.I.C., F.C.S. Pp. viii + 105. Students' Aids Series. (London: Baillière, Tindall and Cox, 1902.) Price 2s. 6d.

THIS little book is intended for the use of students and others to whom the more expensive standard works on analysis and assaying are inaccessible. It is entirely devoted to quantitative estimations, and some two hundred methods are concisely described. It contain